

CLAIMS

- 1     1.     A calibration method handling occurrences of thermometer code bubbles in an  
2     A/D sub-converter in an A/D converter stage, including the steps of:  
3         - detecting two A/D sub-converter comparators causing a bubble;  
4         - increasing the threshold of the bubble causing comparator having the lowest  
5     threshold by a first predetermined voltage; and  
6         - decreasing the threshold of the bubble causing comparator having the  
7     highest threshold by a second predetermined voltage.
- 1     2.     The method of claim 1, wherein said first and second voltages are fractions of  
2     the A/D sub-converter quantization step.
- 1     3.     The method of claim 2, wherein said first voltage is equal to said second  
2     voltage.
- 1     4.     The method of claim 1, including the steps of:  
2         - determining the last A/D sub-converter comparator having a threshold that is  
3     smaller than an analog A/D sub-converter input signal;  
4         - increasing the threshold of said determined comparator by a third  
5     predetermined voltage if a residual signal from said A/D converter stage falls below a  
6     predetermined minimum level; and  
7         - decreasing the threshold of the first A/D sub-converter comparator having a  
8     threshold that is larger than said analog A/D sub-converter input signal by a fourth  
9     predetermined voltage if said residual signal exceeds a predetermined maximum level.
- 1     5.     The method of claim 4, wherein said third and fourth voltages are fractions of  
2     the A/D sub-converter quantization step.
- 1     6.     The method of claim 5, wherein said third voltage is equal to said fourth  
2     voltage.

- 1 7. The method of any of the preceding claims, wherein said thresholds are
- 2 modified by modifying comparator offsets.

- 1 8. A calibration apparatus handling occurrences of thermometer code bubbles in  
2 an A/D sub-converter in an A/D converter stage, comprising:  
3 - means for detecting two A/D sub-converter comparators causing a bubble;  
4 - means for increasing the threshold of the bubble causing comparator having  
5 the lowest threshold by a first predetermined voltage; and  
6 - means for decreasing the threshold of the bubble causing comparator having  
7 the highest threshold by a second predetermined voltage.
- 1 9. The apparatus of claim 8, further comprising:  
2 - means for determining the last A/D sub-converter comparator having a  
3 threshold that is smaller than an analog A/D sub-converter input signal;  
4 - means for increasing the threshold of said determined comparator by a third  
5 predetermined voltage if a residual signal from said A/D converter stage falls below a  
6 predetermined minimum level; and  
7 - means for decreasing the threshold of the first A/D sub-converter comparator  
8 having a threshold that is larger than said analog A/D sub-converter input signal by a  
9 fourth predetermined voltage if said residual signal exceeds a predetermined  
10 maximum level.
- 1 10. The apparatus of claim 8, further comprising means for modifying said  
2 thresholds by modifying comparator offsets.

1 11. A multi-stage A/D converter including a calibration apparatus handling  
2 occurrences of thermometer code bubbles in an A/D sub-converter in at least one A/D  
3 converter stage, said calibration apparatus comprising:

- 4 - means for detecting two A/D sub-converter comparators causing a bubble;
- 5 - means for increasing the threshold of the bubble causing comparator having  
6 the lowest threshold by a first predetermined voltage; and
- 7 - means for decreasing the threshold of the bubble causing comparator having  
8 the highest threshold by a second predetermined voltage.

1 12. The multi-stage A/D converter of claim 11, said calibration apparatus  
2 comprising:

- 3 - means for determining the last A/D sub-converter comparator having a  
4 threshold that is smaller than an analog A/D sub-converter input signal;
- 5 - means for increasing the threshold of said determined. comparator by a third  
6 predetermined voltage if a residual signal from said A/D converter stage falls below a  
7 predetermined minimum level; and
- 8 - means for decreasing the threshold of the first A/D sub-converter comparator  
9 having a threshold that is larger than said analog A/D sub-converter input signal by a  
10 fourth predetermined voltage if said residual signal exceeds a predetermined  
11 maximum level.

1 13. The multi-stage A/D converter of claim 11, further comprising means for  
2 modifying said thresholds by modifying comparator offsets.

- 1    14.    A flash A/D converter handling occurrences of thermometer code bubbles,  
2    comprising:
- 3            - means for detecting two A/D converter comparators causing a bubble;
  - 4            - means for increasing the threshold of the bubble causing comparator having  
5    the lowest threshold by a first predetermined voltage; and
  - 6            - means for decreasing the threshold of the bubble causing comparator having  
7    the highest threshold by a second predetermined voltage.
- 1    15.    The flash A/D converter of claim 14, further comprising means for modifying  
2    said thresholds by modifying comparator offsets.